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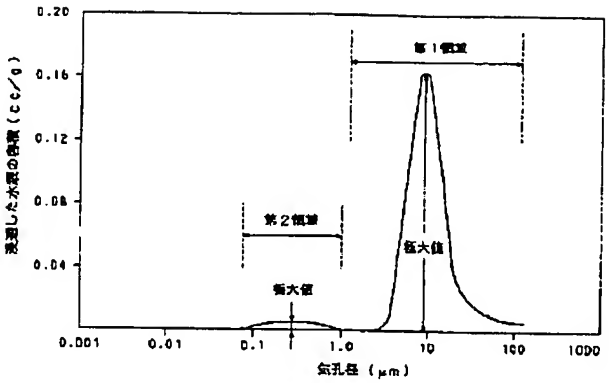
TITLE : EXHAUST GAS FILTER AND EXHAUST GAS CLEANING DEVICE



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(54) EXHAUST GAS FILTER AND EXHAUST GAS CLEANING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To improve mechanical strength and thermal shock resistance by broadly classifying pore distribution at the time of measuring lattice wall by mercury penetration method into 2 specific regions of the pore diameter.

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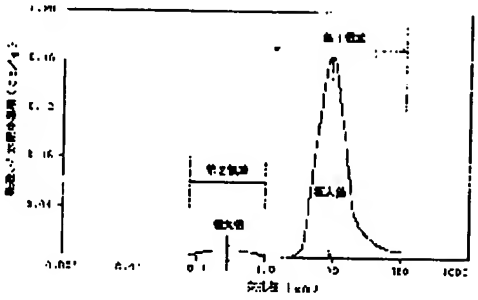

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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] It is the exhaust gas filter from which the particulate in the exhaust gas with which the grid wall which has many through tubes in the direction of an emission way, and forms said through tube in it consists of a porosity ceramic etc. is removed. When the graph which took the pore diameter along the axis of abscissa, and took pore volume along the axis of ordinate is formed in the pore distribution at the time of measuring said grid wall with a method of mercury penetration The exhaust gas filter characterized by roughly being divided into the 1st field whose pore diameter is 2-150 micrometers, and the 2nd field whose pore diameter is 0.08-1 micrometer, and having the maximal value in said the 1st field and said 2nd field, respectively.
[Claim 2] The exhaust gas filter according to claim 1 with which the porosity ceramic of the grid wall which forms many through tubes is characterized by consisting of aluminum titanate as a principal component.
[Claim 3] The exhaust gas filter according to claim 1 characterized by setting to 40-60 pore volume of the pore diameter which shows the maximal value in said 1st field when pore volume of the pore diameter which shows the maximal value in said 2nd field is set to 1 in the pore diameter of 2-150 micrometers of the 1st field, and the pore diameter of 0.08-1 micrometer of the 2nd field.
[Claim 4] The exhaust gas filter according to claim 1 characterized by being in the range whose pore diameter which shows the maximal value in said 2nd field is 0.2-0.5 micrometers in the pore diameter of 0.08-1 micrometer of the 2nd field.
[Claim 5] Claims 1, 2, and 3, an exhaust gas filter given [any 1] in four, and the container that contains said exhaust gas filter, A heating means to heat said exhaust gas filter, and an oxidation material supply means to send in oxidation material, such as air, in said container, If the particulate of the specified quantity etc. adheres to said exhaust gas filter, said heating means and said oxidation material supply means are made to drive. The exhaust gas purge characterized by having the control unit which burns a particulate etc. by sending in oxidization material while making said exhaust gas filter heat.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the exhaust gas filter and exhaust gas purge which filter the particulate contained in the exhaust gas discharged from a diesel power plant etc.
[0002]
[Description of the Prior Art] The particulate (particulate matter, such as soot) processing distributed in atmospheric air with the exhaust gas exhausted from combustion engines, such as a diesel power plant, in connection with the environmental problem having aggravated in recent years attracts attention. Uptake of these particulates is carried out with the exhaust gas filter connected in the middle of the exhaust pipe. If an exhaust gas filter advances particulate uptake as it is, in order to have a bad influence on engine combustion efficiency etc., if predetermined collection volume is reached, a particulate is burned and an exhaust gas filter must be reproduced.
[0003] As for playback of an exhaust gas filter, an electric heater method is mainly used. By the electric heater method, installation and an electric heater are heated, a particulate is heated, an inflow [of exhaust gas] or outflow side is ignited, and an electric heater is burned in it. The combustion temperature at this time is controlled by supply air volume. Since the whole does not burn at once but combustion advances gradually from an edge, a temperature gradient arises in an exhaust gas filter inevitably, and thermal stress generates a particulate. Under the present circumstances, since particulate collection volume cannot be detected correctly but fluctuation of **40% of collection volume occurs frequently to target collection volume, abnormal combustion may occur. This abnormal combustion says the phenomenon of going up rapidly to 1000-degree-C or more thing high temperature, at the time of playback, when uptake of many particulates is carried out from the set point. Therefore, the thermal resistance which is equal to this abnormal combustion is required for an exhaust gas filter. Moreover, low-fever expansibility and high thermal shock resistance are strongly required as fatigue breaking based on the thermal stress at the time of regeneration not producing an exhaust gas filter. Moreover, it is called for that particulate collection efficiency also has little pressure loss highly, and the balance of these properties is very important for it. In order to fill these demands, examination is performed from every direction and, as for the exhaust gas filter, various development is performed.
[0004] For example, a cordierite sintered compact (2MgO, 2aluminum2 O3, and 5SiO2) is mentioned as an ingredient used for an exhaust gas filter. The crystal of cordierite shows different direction-thermal expansion, an a-axis differs from 2.0x10-6/degree C, and, as for the coefficient of thermal expansion, the c-axis differs from -0.9x10-6/degree C. However, since plate crystal contained in a raw material, such as a kaolin and talc, extrudes, shearing force is received at a process and it distributes in the direction parallel to a grid, at a sintering process, this plate crystal serves as a sintering crystal growth origin, and the c-axis of the crystal of cordierite will be in the condition that slightly many orientation in the direction of extrusion (the direction of an emission way) was carried out. Therefore, the coefficient of thermal expansion of the direction of extrusion of cordierite becoming 0.4 - 0.7x10-6/degree C, and the coefficient of thermal expansion of a direction perpendicular to the direction of extrusion becoming 0.9 - 1.5x10-6/degree C, crossing in all the directions, and a coefficient of thermal expansion becoming small, and working in favor of a thermal shock is examined.
[0005] Moreover, aluminum titanate (aluminum 2O3 and TiO2) is mentioned as an ingredient for other exhaust gas filters. Aluminum titanate is resistant to the abnormal combustion which

melting temperature is as high as 1600 degrees C or more, and is generated at the time of playback of an exhaust gas filter, and excellent in thermal resistance. Although different direction-thermal expansion is shown like [crystal / of aluminum titanate] the crystal of cordierite, 11.8x10-6/degree C and a b-axis compare with 19.4x10-6/degree C, a c-axis compares with -2.6x10-6/degree C and the crystal of cordierite, and, as for the coefficient of thermal expansion of the crystal of aluminum titanate, the a-axis has the big anisotropy. Aluminum titanate has the property which starts and forms a micro crack into high temperature expansion among aluminum titanate crystal grain children harder [with a big anisotropy]. Moreover, aluminum titanate also has the property to be easy to decompose into oxidization titanium and an aluminum oxide, under high temperature. Thus, although aluminum titanate is the ingredient excellent in low-fever expansibility and high thermal resistance, it can say it also as the ingredient which a mechanical strength tends (based on a crystal grain child's decomposition) to form into high temperature expansion low (based on the micro crack between crystal grain children) compared with other ceramic ingredients.

[0006] In order to solve the mechanical strength of aluminum titanate, and the problem about decomposition, in a JP,63-11585,A official report, it is SiO2. : 1 - 10wt%, aluminum 2O3 : 1 - 10wt%, Fe 2O3 : The technique of the porosity Plastic solid of the aluminum titanate containing 0.1 - 5wt% is indicated. The above-mentioned component exists in this Plastic solid as the solid solution, and an aluminum titanate crystal grain child's decomposition control and improvement in a mechanical strength are enabled.

[0007]

[Problem(s) to be Solved by the Invention] However, although the grid walls which constitute an exhaust gas filter about a mechanical strength although the effectiveness about decomposition control is large about the exhaust gas filter produced by the ingredient presentation which enabled an aluminum titanate crystal grain child's decomposition control and improvement in a mechanical strength are the porous ceramics which have much free passage pores therefore, they are inadequate.

[0008] In the exhaust gas filter which consists of aluminum titanate as a principal component, 1 burning shrinkage becomes large, and dimensional accuracy worsens (when using aluminum titanate with small crystal particle diameter and compounding aluminum titanate from what has small /raw material particle diameter).

2) A mechanical strength becomes low, and vibratility-proof is spoiled (when aluminum titanate with large crystal particle diameter is used and there is no orientation in the direction of passage of an exhaust gas filter, and the perpendicular direction of the direction of passage).

3) Crystalline anisotropy became large, and it had technical problems -- thermal shock resistance is spoiled -- (when aluminum titanate with large crystal particle diameter is used and orientation is too large to the direction of passage of an exhaust gas filter, and the perpendicular direction of the direction of passage).

[0009] This invention solves the above technical problem and it aims at offering the exhaust gas filter and exhaust gas purge which raised a mechanical strength and thermal shock resistance.

[0010]

[Means for Solving the Problem] In order to solve this technical problem, this invention was roughly divided into the 1st field whose pore diameter of the grid wall which has many through tubes in the direction of an emission way, and forms a through tube in it is 2-150 micrometers, and the 2nd field which is 0.08-1 micrometer, and it was constituted so that it might have the maximal value in the 1st field and 2nd field, respectively.

[0011] According to this invention, the exhaust gas filter and exhaust gas purge which raised a mechanical strength and thermal shock resistance can be offered.

[0012]

[Embodiment of the Invention] Invention of this invention according to claim 1 is an exhaust gas filter from which the particulate in the exhaust gas with which the grid wall which has many through tubes in the direction of an emission way, and forms said through tube in it consists of a porosity ceramic etc. is removed. When the graph which took the pore diameter along the axis of abscissa, and took pore volume along the axis of ordinate is formed in the pore distribution at

the time of measuring said grid wall with a method of mercury penetration It is roughly divided into the 1st field whose pore diameter is 2-150 micrometers, and the 2nd field whose pore diameter is 0.08-1 micrometer, it constitutes so that it may have the maximal value in said the 1st field and said 2nd field, respectively, and it has an operation that a mechanical strength and thermal shock resistance improve.

[0013] In claim 1, the porosity ceramic of the grid wall which forms many through tubes considers invention of this invention according to claim 2 as the configuration which consists of aluminum titanate as a principal component, and it has an operation that high thermal resistance and low-fever expansibility improve.

[0014] Invention of this invention according to claim 3 is set in claim 1 in the pore diameter of 2-150 micrometers of the 1st field, and pore diameter of 0.08-1 micrometer of the 2nd field. When pore volume of the pore diameter which shows the maximal value in said 2nd field is set to 1, it has an operation that it can consider as the configuration which sets to 40-60 pore volume of the pore diameter which shows the maximal value in said 1st field, and the stable mechanical strength and uptake capacity can be acquired.

[0015] Invention of this invention according to claim 4 has an operation that it can consider as the configuration in the range whose pore diameter which shows the maximal value in said 2nd field is 0.2-0.5 micrometers, and the stable mechanical strength can be obtained, in the pore diameter of 0.08-1 micrometer of the 2nd field in claim 1.

[0016] Invention of this invention according to claim 5 Claims 1, 2, and 3 and an exhaust gas filter given [any 1] in four, The container which contains said exhaust gas filter, and a heating means to heat said exhaust gas filter, If the particulate of the specified quantity etc. adheres to an oxidization material supply means to send in oxidization material, such as air, in said container, and said exhaust gas filter, said heating means and said oxidization material supply means are made to drive. It considers as the configuration which has the control unit which burns a particulate etc. by sending in oxidization material while making said exhaust gas filter heat. Since uptake capacity increases while an exhaust gas filter is firmly fixable, it has an operation that the uptake of the fine particulate etc. can be carried out.

[0017] Hereafter, it explains, referring to drawing 1 - drawing 5 about the gestalt of operation of this invention.

(Gestalt of operation) Drawing 1 is the perspective view showing the exhaust gas filter by the gestalt of 1 operation of this invention, and the partial enlarged drawing of the passage side of the exhaust gas filter according [drawing 2] to the gestalt of 1 operation of this invention and drawing 3 are the sectional views of the exhaust gas filter by the gestalt of 1 operation of this invention.

[0018] In drawing 1 , 1 is an exhaust gas filter, the exhaust gas filter 1 has the shape of a cylindrical shape, and the diameter of the passage sides 1a and 1b of the exhaust gas which exists up and down is about 130-158mm, and the die length which met in the direction of an emission way is constituted so that it may be set to 137mm - about 167mm. The magnitude of this exhaust gas filter 1 is the magnitude which is used suitable for 2000-3000 cc of engine displacements, and can moreover carry out uptake of the particulate of the exhaust gas of that displacement etc. efficiently. Since process tolerance can be raised and stress can moreover be distributed isotropic by making the exhaust gas filter 1 cylindrical, processing distortion etc. can be reduced. 1c is the side face of the exhaust gas filter 1, and although pore may be formed in side-face 1c, since it is stuck with the heat insulator etc., particulate leakage is not generated. In case the exhaust gas filter 1 is attached in equipment etc., as the exhaust gas filter 1 is wrapped in the heat insulator of the quality of an inorganic fiber etc. and it puts in casing material, such as SUS, further, it is fixed in equipment and held.

[0019] In addition, with the gestalt of this operation, although the diameter of the passage sides 1a and 1b was made almost the same, by attaching a taper to side-face 1c, the diameter by the side of passage side 1a may be made larger than the diameter by the side of passage side 1b, or the diameter by the side of passage side 1b may be formed reversely [the] more greatly than the diameter by the side of passage side 1a. In addition, since the direction which made exhaust gas flow into the exhaust gas filter 1 from a passage side side with a larger diameter can make

inflow area large, pressure loss is low and, moreover, can make [many] the amounts of collections, such as a particulate.

[0020] In drawing 2 , two or more cross-section rectangle-like through tubes 2 are formed in passage side 1a along the direction of an emission way of the exhaust gas filter 1, and the through tube 2 is divided with the grid wall 3 with which much free passage pores were prepared. The grid wall 3 consists of passage side 1a continuously to passage side 1b. The thickness t1 of the grid wall 3, and t2 It is desirable to constitute within the limits of 0.2-0.3mm (200 cel / square inch) and 0.4-0.5mm (100 cel / square inch), respectively. When it deviates from this range, a mechanical strength may become small too much, collection efficiency may fall, or fault, like pressure loss becomes high may be produced.

[0021] Since the moldability was thought as important by the extrusion-molding approach and the exhaust gas filter was produced with the gestalt of this operation, it is t1 =t2. Although carried out, it sets to other shaping approaches (for example, laminating of a processing sheet), and it is t1 <t2. Relation and t1 > t2 You may make it relation. For example, in drawing 2 , since flow control of exhaust gas making it easy to flow is made to the grid wall 3 parallel to the direction of M by thickening thickness of the grid wall 3 parallel to the direction of L, and making thin thickness of the grid wall 3 parallel to the direction of M, the flow of the exhaust gas which passed the exhaust gas filter 1 can be controlled, and the exhaust air effectiveness of the exhaust gas filter 1 etc. can be adjusted. In addition, by making thickness of the internal grid wall 3 thicker than the periphery section (part near side-face 1c), since it becomes easy to pass exhaust gas, the periphery section can make [more] the through put of the exhaust gas of the periphery section than the interior, and generally much exhaust gas can be passed in the periphery section with little exhaust gas through put. Therefore, the exhaust gas filter 1 can equalize collection volume, such as a particulate, in each part, and can raise the uptake property of the exhaust gas filter 1. Moreover, by making thickness of the grid wall 3 of the periphery section thicker than the interior, the mechanical strength of the periphery section can be raised and breakage of the exhaust gas filter 1 by past [a bundle], vibration, etc. at the time of fixing the exhaust gas filter 1 to the interior of equipment etc. can be prevented.

[0022] Moreover, pitch A1 which met in the direction of L of the grid wall 3 Pitch A2 which met in the direction of M The inside of the range of 2mm - 4mm (when it deviates from this range, collection efficiency may fall or fault, like pressure loss becomes high may arise) is desirable respectively. It sets in the gestalt of this operation and is A1 =A2. Since uptake capacity is made to homogeneity in each part while being able to raise a mechanical strength isotropic by having carried out, the stable property can be acquired. In addition, pitch A1 And pitch A2 The cross-section configuration of a through tube 2 is made into a rectangle by making it different size, the amount of the exhaust gas which passes the grid wall 3 in each part is adjusted, the bias of collection capacity can be formed, and since change can be given to flow rate distribution of the exhaust gas which passed the exhaust gas filter 1, the design of piping, the design of the stowage container of the exhaust gas filter 1, etc. become easy.

[0023] Furthermore, as for the formation consistency of a through tube 2, in the passage sides 1a and 1b, about 100-200 per 1 square inch are desirable.

[0024] the sealing agent with which 4 was stuffed into the through tube 2 -- it is -- a sealing agent 4 -- through tube 2 comrades -- ********** -- it is stuffed like. If this sealing agent 4 is constituted from same ingredient as the grid wall 3, it can prevent breakage of the grid wall 3 by the difference in a coefficient of thermal expansion etc. between the grid wall 3 and a sealing agent 4. In addition, even if it does not constitute the grid wall 3 and a sealing agent 4 from same ingredient, as long as a coefficient of thermal expansion etc. chooses a near thing etc., the grid wall 3 and a sealing agent 4 may consist of different ingredients.

[0025] moreover, the grid wall 3 and a sealing agent 4 -- the principal component of each component can also be made the same, and, in addition, the class of additive, its amount, etc. may be changed. Since it can adjust to the hardness which is easy to stuff a sealing agent 4 since the coefficient of thermal expansion of the grid wall 3 and a sealing agent 4 can be made almost the same by making it such a configuration and the property of a sealing agent 4 can moreover be changed, workability becomes good and productivity improves.

[0026] a sealing agent 4 -- the passage sides 1a and 1b -- by preparing in each through tube 2, as shown in drawing 3 , a through tube 2 is classified into incurrent pore 2a and outflow hole 2b. If exhaust gas is slushed into the exhaust gas filter 1 from the passage side 1a side, after exhaust gas enters into incurrent pore 2a first, it will enter into outflow hole 2b through the grid wall 3, and will be emitted outside. In case exhaust gas passes the porous grid wall 3 at this time, uptake of the particulate in exhaust gas etc. is carried out into the grid wall 3.
[0027] The following presentations are mentioned if it considers as the ingredient which constitutes the exhaust gas filter 1.
[0028]
aluminum2 O3 ... 47.2-57.8wt%TiO2 ... 36.4-44.6wt%SiO2 ... 3.0- 9.0wt% -- Fe2 O3 ... 0.7-
Including the 2.7wt% above-mentioned presentation respectively, it prepared so that it might moreover become 100wt(s)% including some impurities. as an impurity -- for example, ZrO2 etc. -- it is mentioned. Thus, since it is hard to start an erosion and has a low-fever expansion coefficient further even if it will be in an elevated-temperature condition, since it excels in thermal resistance by using aluminum titanate as a principal component, it is hard to be divided in thermal stress etc.
[0029] Although the above-mentioned ingredient constituted the exhaust gas filter 1 whole (part which constitutes side-face 1c of the grid wall 3 and the exhaust gas filter 1) from the gestalt of this operation, it is desirable to constitute the grid wall 3 from an above-mentioned ingredient at least.
[0030] Drawing 4 is a graph which shows pore distribution of the exhaust gas filter by the gestalt of 1 operation of this invention. In drawing 4 , it turns out that it is the pore distribution which has [between (it abbreviates to the 1st field below) with a pore diameter of 2-150 micrometers] the maximal value, respectively with a pore diameter of 0.08-1 micrometer (it abbreviates to the 2nd field below) in between. The gestalt of this operation can be characterized by the maximal value of a pore diameter existing in the 2nd field, and can raise the mechanical strength and thermal shock resistance of the exhaust gas filter 1 by existence of this maximal value. Although a coefficient of thermal expansion also becomes isotropic and each direction shows a small coefficient of thermal expansion when there is no orientation about the perpendicular direction of the direction of an emission way, and the direction of passage, a big and rough micro crack exists in aluminum titanate, and a mechanical strength is low. Although each direction shows a high thermal expansion (a direction [The coefficient of thermal expansion of 800 degrees C: The direction / For example, room temperature - / of an emission way -2.5x10-] perpendicular to 6/degree C and the direction of passage 2.4x10- 6/degree C) and thermal shock resistance is low when there is big orientation about the perpendicular direction of the direction of an emission way and the direction of passage, a micro crack becomes detailed and a mechanical strength increases. That is, if the maximal value of a pore diameter exists in the 2nd field, the big and rough micro crack of aluminum titanate can be reduced, and a high thermal expansion is not shown in coincidence. If these pore distribution is incidentally explained, since many big and rough micro cracks will occur about an exhaust gas filter without orientation, the pore distribution which hits the 2nd field is shifted to the one where a pore diameter is larger (for example, 0.1-2 micrometers), and is larger than drawing 4 . [of pore volume] Moreover, the pore distribution which hits the 2nd field is shifted to the one where a pore diameter is lower than drawing 4 about the exhaust gas filter with large orientation (the 2nd field is 0.06-0.5 micrometers). As mentioned above, the 2nd field shows the pore distribution by the micro crack, and the magnitude of orientation changes with the fields. In this example, the 2nd field serves as the pore diameter range of 0.08-1 micrometer.
[0031] Next, the measuring method of drawing 4 etc. is explained. It asked for the data shown in drawing 4 with the method of mercury penetration. As for a method of mercury penetration, mercury asks the exhaust gas filter 1 for what cc perg permeates. An experiment contains the grid wall 3 of the exhaust gas filter 1 in a predetermined container, in the container, changes a pressure gradually and presses mercury fit. When the pressure in a container is low, only mercury enters into comparatively big pore, and when a pressure is high, mercury enters even into small pore. Therefore, it can measure how many predetermined pore diameters exist by

measuring what cc [perg] mercury enters into the grid wall 3 of the exhaust gas filter 1 at the time of a predetermined pressure.
[0032] With the gestalt of this operation, the Shimadzu Corp. make (MAIKUROMERI tex POA riser 9320 form) was used on the occasion of the experiment. Thus, the measured result is the graph shown in drawing 4 .
[0033] In drawing 4 , an axis of ordinate takes the volume of the mercury which permeated the grid wall 3 of the exhaust gas filter 1 perg, and an axis of abscissa is the pore diameter called for from the pressure in the container which contained the grid wall 3 and mercury of an exhaust gas filter. As drawing 4 shows, the pore which has a pore diameter near 10 micrometer exists most mostly, and, moreover, as for distribution of a pore diameter, it turns out that it has the two maximal value. That is, it turns out that it has the maximal value in the 1st above-mentioned field and the 2nd above-mentioned field at least, respectively.
[0034] Moreover, when the maximal value which exists in the 2nd field is set to 1, as for the maximal value which exists in the 1st field, it is desirable to be referred to as 40-60 (especially preferably 45-55). If it is within the limits of this, sufficient mechanical strength and uptake capacity can be acquired.
[0035] As for the maximal value of a pore diameter, existing among 0.2-0.5 micrometers is still more desirable also in the 2nd field. The exhaust gas filter 1 which could realize improvement in a mechanical strength and thermal shock resistance, and was stabilized with constituting the exhaust gas filter 1 so that the maximal value of a pore diameter may come to this range is producible.
[0036] As the manufacture approach of the exhaust gas filter 1, a predetermined raw material is mixed first, a binder, an ostomy agent, etc. are put in into it, it considers as the shape of a plastic matter, and the plastic matter-like object is fabricated by the extrusion-molding method in a honeycomb configuration, and after drying the Plastic solid, it is filled up with a sealing agent, it calcinates and is produced. In shifting the maximal value of the above-mentioned pore diameter or changing a rate, it changes the class of ostomy agent, particle size, an addition and the particle size of a ceramic raw material, a configuration, etc.
[0037] Drawing 5 is the schematic diagram showing the exhaust gas purge by the gestalt of 1 operation of this invention. As for the heat insulator with which an engine and 11 contain an exhaust gas filter and, as for 12, 10 contains the exhaust gas filter 11 in drawing 5 , the container with which 13 contains the exhaust gas filter 11 and a heat insulator 12, the heating object with which 14 supplies heat to the exhaust gas filter 11, the pressure sensor with which 15 measures the pressure in a container 13, and 16, a blower and 17 are control units.
[0038] The actuation is explained below about the exhaust gas purge constituted as mentioned above.
[0039] The exhaust gas which came out of the engine 10 first is introduced in a container 13, and after exhaust gas is removed by the exhaust gas filter 11 in a particulate etc., it is emitted outside. If the exhaust gas filter 11 reaches a predetermined pressure loss value, a pressure sensor 15 will detect and a control device 17 will stop an engine 10. Next, if a blower 16 is made to drive and air is slushed in a container 13 while making the heating object 14 generate heat, the particulate in which uptake was carried out to the exhaust gas filter 11 by heat and air will be lit. Particulate combustion is spread towards the other end side of the exhaust gas filter 11 from the heating object 14 side.
[0040]
[Example] Next, the example of this invention is explained.
[0041] (Example) About the exhaust gas filter in this example, a coefficient of thermal expansion, the data measured with the method of mercury penetration, a mechanical strength (compressive strength), thermal shock resistance, etc. were summarized for considering as a sample 1 (Table 1). In addition, it was shown in the table where the same is said of the example of a comparison (samples 2 and 3).
[0042]
[Table 1]

試料No	熱膨張係数 室温~800℃ :10^{-6}/℃		第2領域の範囲 (μm)	機械的強度 (kgf/cm^2)	再生後の状態 補集量 15g/l :100サイクル後
	流路方向	垂直方向		流路方向	
1	-1.4	1.5	0.08~1.0	61	クラック無し
2	-0.2	-0.1	0.1 ~2.0	37	クラック有り
3	-2.5	2.4	0.06~0.5	76	クラック有り

[0043] Sample No made the order of 2, 1, and 3 enlarge an aluminum titanate crystal grain child's orientation.
[0044] About a sample 2, there is no difference of a coefficient of thermal expansion to the measurement direction of an exhaust gas filter, and orientation has hardly been carried out. About this sample 2, since it has a big and rough micro crack by 0.1-2 micrometers, the 2nd field has a low mechanical strength. Moreover, since the mechanical strength is low, thermal shock resistance is also known by that it is low.
[0045] About a sample 3, the difference of a coefficient of thermal expansion is large to the measurement direction of an exhaust gas filter. Although the 2nd field of a mechanical strength is high about this sample 3 at 0.06-0.5 micrometers, since the difference of a coefficient of thermal expansion is large, it turns out that thermal shock resistance is also low.
[0046] About a sample 1, while a certain amount of stacking tendency is shown, it can be said that a mechanical strength is high thermal shock resistance highly. The range of the 2nd field of this sample was 0.08-1 micrometer.
[0047]
[Effect of the Invention] It is the exhaust gas filter from which the particulate in the exhaust gas with which the grid wall which has many through tubes in the direction of an emission way, and forms a through tube in it according to this invention as mentioned above consists of a porosity ceramic etc. is removed. When the graph which took the pore diameter along the axis of abscissa, and took pore volume along the axis of ordinate is formed in the pore distribution at the time of measuring a grid wall with a method of mercury penetration A mechanical strength and thermal shock resistance can be improved by roughly having been divided into the 1st field whose pore diameter is 2-150 micrometers, and the 2nd field whose pore diameter is 0.08-1 micrometer, and having considered as the configuration which has the maximal value in the 1st field and 2nd field, respectively.

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The perspective view showing the exhaust gas filter by the gestalt of 1 operation of

this invention
[Drawing 2] Drawing 2 is the partial enlarged drawing of the passage side of the exhaust gas filter by the gestalt of 1 operation of this invention.
[Drawing 3] Drawing 3 is the sectional view of the exhaust gas filter by the gestalt of 1 operation of this invention.
[Drawing 4] The graph which shows pore distribution of the exhaust gas filter by the gestalt of 1 operation of this invention
[Drawing 5] The schematic diagram showing the exhaust gas purge by the gestalt of 1 operation of this invention
[Description of Notations]
1 11 Exhaust gas filter
2 Through Tube
3 Grid Wall
4 Sealing Agent
10 Engine
12 Heat Insulator
13 Container
14 Heating Object
15 Pressure Sensor
16 Blower
17 Control Unit

[Translation done.]

* NOTICES *

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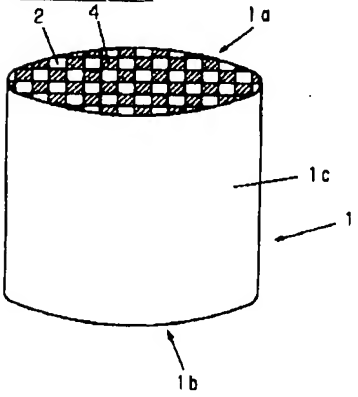
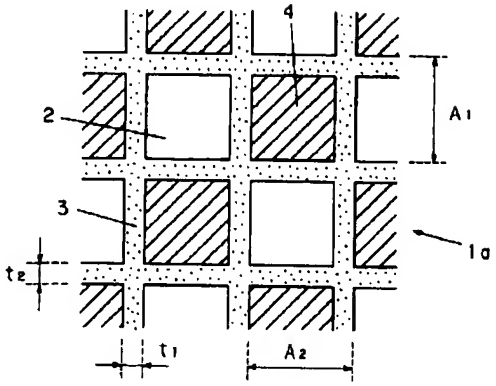
3.In the drawings, any words are not translated.

DRAWINGS

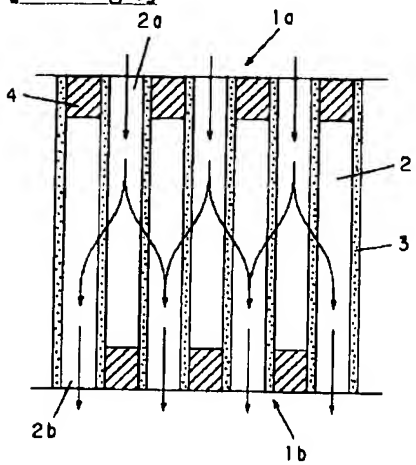
[Drawing 1]



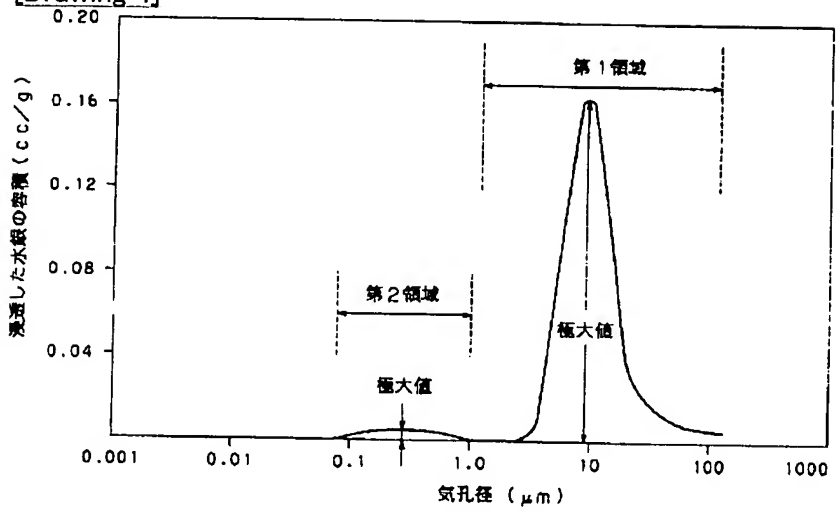
[Drawing 2]



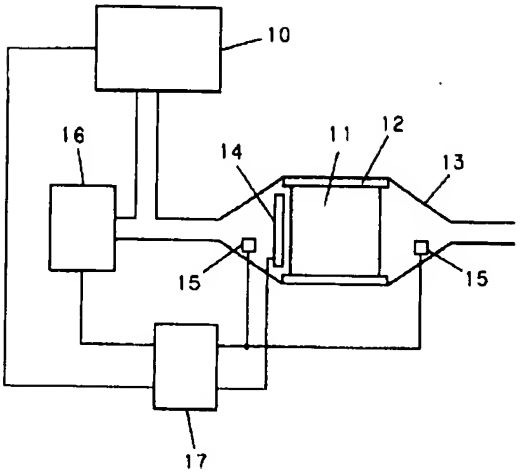
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]

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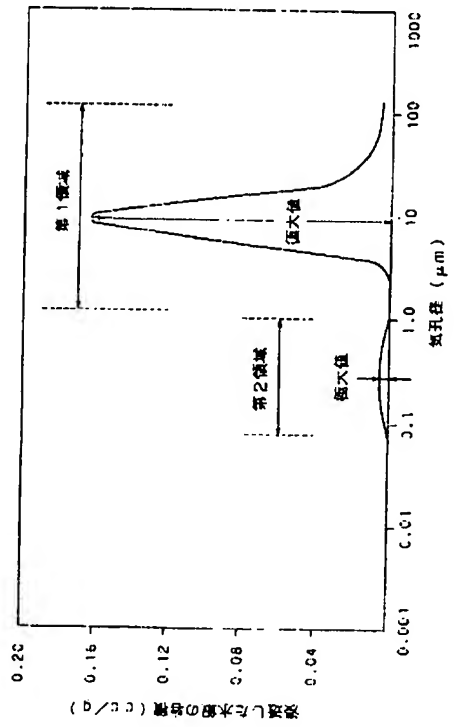
最終頁に続く

(54)【発明の名称】　排ガスフィルタ及び排ガス浄化装置

(57)【要約】

【課題】　機械的強度と耐熱衝撃性を向上させた排ガスフィルタを提供することを目的とする。

【解決手段】　排ガス流路方向に多数の貫通孔を有し貫通孔を形成する格子壁が多孔質のセラミックからなる排ガス中のパティキュレート等を除去する排ガスフィルタであり、格子壁の気孔分布において、横軸に気孔径，縦軸に細孔容積をとったグラフを形成した時に、気孔径が2～150μmである第1の領域と気孔径が0．08～1μmである第2の領域に大きく分けられ、第1の領域と第2の領域においてそれぞれ極大値を有するように構成した。



【特許請求の範囲】
【請求項1】排ガス流路方向に多数の貫通孔を有し前記貫通孔を形成する格子壁が多孔質セラミックからなる排ガス中のパティキュレート等を除去する排ガスフィルタであって、前記格子壁を水銀圧入法にて測定した際の気孔分布において、横軸に気孔径，縦軸に細孔容積をとったグラフを形成した時に、気孔径が2～150μmである第1の領域と気孔径が0．08～1μmである第2の領域に大きく分けられ、前記第1の領域と前記第2の領域においてそれぞれ極大値を有することを特徴とする排ガスフィルタ。
【請求項2】多数の貫通孔を形成する格子壁の多孔質セラミックが、主成分としてチタン酸アルミニウムからなることを特徴とする請求項1記載の排ガスフィルタ。
【請求項3】第1の領域の気孔径2～150μmと第2の領域の気孔径0．08～1μmにおいて、前記第2の領域で極大値を示す気孔径の細孔容積を1とした時に、前記第1の領域で極大値を示す気孔径の細孔容積を40～60としたことを特徴とする請求項1記載の排ガスフィルタ。
【請求項4】第2の領域の気孔径0．08～1μmにおいて、前記第2の領域で極大値を示す気孔径が0．2～0．5μmの範囲にあることを特徴とする請求項1記載の排ガスフィルタ。
【請求項5】請求項1、2、3、4いずれか1記載の排ガスフィルタと、前記排ガスフィルタを収納する容器と、前記排ガスフィルタを加熱する加熱手段と、前記容器内に空気などの酸化材を送り込む酸化材供給手段と、前記排ガスフィルタに所定量のパティキュレート等が付着したら前記加熱手段と前記酸化材供給手段を駆動させて、前記排ガスフィルタを加熱させるとともに酸化材を送り込むことによってパティキュレート等を燃焼させる制御装置を有することを特徴とする排ガス浄化装置。
【発明の詳細な説明】
【0001】
【発明の属する分野】本発明は、ディーゼルエンジン等から排出される排ガス中に含まれるパティキュレート等を沪過する排ガスフィルタ及び排ガス浄化装置に関するものである。
【0002】
【従来の技術】近年、環境問題が深刻化したことに伴いディーゼルエンジン等の燃焼機関から排気される排気ガスとともに大気中に分散されるパティキュレート（スス等の粒子状物質）の処理が注目を集めている。これらのパティキュレートは排気管の途中に接続された排ガスフィルタにより捕集される。排ガスフィルタがそのままパティキュレートの捕集を進めるとエンジンの燃焼効率等に悪影響を及ぼすため、所定の捕集量に達するとパティキュレートを燃焼し排ガスフィルタを再生せねばならない。
【0003】排ガスフィルタの再生は主として電気ヒータ方式が用いられる。電気ヒータ方式では排ガスの流入側もしくは流出側に電気ヒータを据付、電気ヒータを加熱してパティキュレートを加熱，発火させ燃焼させる。この時の燃焼温度は供給空気量により制御される。パティキュレートは全体が一度に燃焼するのではなく端部から徐々に燃焼が進行するので、必然的に排ガスフィルタに温度勾配が生じ熱応力が発生する。この際、パティキュレートの捕集量を正確に検知することができず目標捕集量に対して±40%の捕集量の変動が頻繁に発生するため異常燃焼が発生する可能性がある。この異常燃焼とは設定値より多くのパティキュレートが捕集された場合、再生時に1000℃以上もの高温度に急激に上昇する現象をいう。そのため、排ガスフィルタはこの異常燃焼に耐える耐熱性が必要である。また、排ガスフィルタは再生処理時の熱応力に基づいた疲労破壊が生じないように低熱膨張性，高耐熱衝撃性が強く要求される。また、パティキュレートの捕集効率が高く圧力損失の少ないことも求められ、これらの特性のバランスが極めて重要である。これらの要求を満たすため排ガスフィルタは各方面から検討が行われ種々の開発が行われている。
【0004】例えば、排ガスフィルタに用いる材料としてコージェライト焼結体（$2MgO \cdot 2Al_2O_3 \cdot 5SiO_2$）が挙げられる。コージェライトの結晶は異方的な熱膨張を示し熱膨張係数はa軸が2.0×10^{-6}/℃、c軸が-0.9×10^{-6}/℃と異なっている。しかしながら、原料に含まれるカオリンやタルク等の板状結晶が押出し工程で剪断力を受け格子と平行な方向に分散されるので、焼結工程でこの板状結晶が焼結結晶の成長起点となりコージェライトの結晶のc軸は押出し方向（排ガス流路方向）に僅かながら多く配向された状態となる。従って、コージェライトの押出し方向の熱膨張係数は0．4～0．7/10^{-6}/℃となり押出し方向に垂直な方向の熱膨張係数は0．9～1．5/10^{-6}/℃となり全方向に渡って熱膨張係数が小さくなり熱衝撃に有利に働くことが検討されている。
【0005】また、他の排ガスフィルタ用の材料としてチタン酸アルミニウム（$Al_2O_3 \cdot TiO_2$）が挙げられる。チタン酸アルミニウムは溶融温度が1600℃以上と高く排ガスフィルタの再生時に発生する異常燃焼に対して抵抗力があり耐熱性に優れている。チタン酸アルミニウムの結晶についてもコージェライトの結晶と同様に異方的な熱膨張を示すが、チタン酸アルミニウムの結晶の熱膨張係数はa軸が11．8/10^{-6}/℃、b軸が19．4/10^{-6}/℃、c軸が-2.6/10^{-6}/℃とコージェライトの結晶と比べて大きな異方性を有している。チタン酸アルミニウムは、大きな異方性を持つがためにチタン酸アルミニウム結晶粒子間にマイクロクラックを起こして高熱膨張化する性質がある。また、チタン酸アルミニウムは高温度下において酸化チタニウムと

酸化アルミニウムに分解しやすいという性質も持っている。この様に、チタン酸アルミニウムは低熱膨張性，高耐熱性に優れた材料ではあるが、他のセラミック材料に比べて機械的強度が低く（結晶粒子間のマイクロクラックによる）高熱膨張化しやすい（結晶粒子の分解による）材料ともいえる。

【０００６】チタン酸アルミニウムの機械的強度や分解についての問題を改善するために、特開昭６３－１１５８５公報にはSiO_2：１～１０wt%，Al_2O_3：１～１０wt%，Fe_2O_3：０．１～５wt%を含んだチタン酸アルミニウムの多孔質成形体の技術が開示されている。この成形体には上記成分が固溶体として存在し、チタン酸アルミニウム結晶粒子の分解抑制と機械的強度の向上を可能としている。

【０００７】

【発明が解決しようとする課題】しかしながら、チタン酸アルミニウム結晶粒子の分解抑制と機械的強度の向上を可能とした材料組成にて作製した排ガスフィルタについては、分解抑制についての効果は大きいが、機械的強度については排ガスフィルタを構成する格子壁が多数の連通気孔を有する多孔質セラミックスであるが故に不十分なものである。

【０００８】主成分としてチタン酸アルミニウムからなる排ガスフィルタにおいては、

１）焼成収縮率が大きくなり、寸法精度が悪くなる（結晶粒子径が小さいチタン酸アルミニウムを使用する場合／原料粒子径が小さいものからチタン酸アルミニウムを合成する場合）

２）機械的強度が低くなり、耐振動性が損なわれる（結晶粒子径が大きいチタン酸アルミニウムを使用し、排ガスフィルタの流路方向と流路方向の垂直方向に配向がない場合）

３）結晶の異方性が大きくなり、耐熱衝撃性が損なわれる（結晶粒子径が大きいチタン酸アルミニウムを使用し、排ガスフィルタの流路方向と流路方向の垂直方向に配向が大きすぎる場合）等の課題を有していた。

【０００９】本発明は以上の課題を解決し、機械的強度と耐熱衝撃性を向上させた排ガスフィルタ及び排ガス浄化装置を提供することを目的とする。

【００１０】

【課題を解決するための手段】この課題を解決するために本発明は、排ガス流路方向に多数の貫通孔を有し貫通孔を形成する格子壁の気孔径が２～１５０μmである第１の領域と０．０８～１μmである第２の領域に大きく分けられ、第１の領域と第２の領域においてそれぞれ極大値を有するように構成した。

【００１１】この発明によれば、機械的強度と耐熱衝撃性を向上させた排ガスフィルタ及び排ガス浄化装置を提供することができる。

【００１２】

【発明の実施の形態】本発明の請求項１に記載の発明は、排ガス流路方向に多数の貫通孔を有し前記貫通孔を形成する格子壁が多孔質セラミックからなる排ガス中のパティキュレート等を除去する排ガスフィルタであって、前記格子壁を水銀圧入法にて測定した際の気孔分布において、横軸に気孔径，縦軸に細孔容積をとったグラフを形成した時に、気孔径が２～１５０μmである第１の領域と気孔径が０．０８～１μmである第２の領域に大きく分けられ、前記第１の領域と前記第２の領域においてそれぞれ極大値を有するように構成したものであり、機械的強度と耐熱衝撃性が向上するという作用を有する。

【００１３】本発明の請求項２に記載の発明は、請求項１において、多数の貫通孔を形成する格子壁の多孔質セラミックが、主成分としてチタン酸アルミニウムからなる構成としたものであり、高耐熱性と低熱膨張性が向上するという作用を有する。

【００１４】本発明の請求項３に記載の発明は、請求項１において、第１の領域の気孔径２～１５０μmと第２の領域の気孔径０．０８～１μmにおいて、前記第２の領域で極大値を示す気孔径の細孔容積を１とした時に、前記第１の領域で極大値を示す気孔径の細孔容積を４０～６０とする構成としたものであり、安定した機械的強度と捕集能力を得ることができるという作用を有する。

【００１５】本発明の請求項４に記載の発明は、請求項１において、第２の領域の気孔径０．０８～１μmにおいて、前記第２の領域で極大値を示す気孔径が０．２～０．５μmの範囲にある構成としたものであり、安定した機械的強度を得ることができるという作用を有する。

【００１６】本発明の請求項５に記載の発明は、請求項１、２、３、４いずれか１記載の排ガスフィルタと、前記排ガスフィルタを収納する容器と、前記排ガスフィルタを加熱する加熱手段と、前記容器内に空気などの酸化材を送り込む酸化材供給手段と、前記排ガスフィルタに所定量のパティキュレート等が付着したら前記加熱手段と前記酸化材供給手段を駆動させて、前記排ガスフィルタを加熱させるとともに酸化材を送り込むことによってパティキュレート等を燃焼させる制御装置を有する構成としたものであり、排ガスフィルタを強固に固定することができると共に捕集能力が高まるので細かなパティキュレート等を捕集できるという作用を有する。

【００１７】以下、本発明の実施の形態について図１～図５を参照しながら説明する。

（実施の形態）図１は本発明の一実施の形態による排ガスフィルタを示す斜視図であり、図２は本発明の一実施の形態による排ガスフィルタの流路面の部分拡大図、そして図３は本発明の一実施の形態による排ガスフィルタの断面図である。

【００１８】図１において１は排ガスフィルタで、排ガスフィルタ１は円柱形状を有しており、上下にある排ガ

スの流路面1a，1bの直径が130～158mm程度であり、排ガス流路方向に沿った長さは137mm～167mm程度になるように構成されている。この排ガスフィルタ1の大きさは、エンジン排気量2000～3000ccに好適に用いられ、しかもその排気量の排ガスのパティキュレート等を効率的に捕集できる大きさである。排ガスフィルタ1を円柱状とすることによって、加工精度を向上させることができ、しかも等方的に応力を分布させることができるので、加工歪等を低減させることができる。1cは排ガスフィルタ1の側面で、側面1cには気孔が形成されている場合もあるが断熱材等で密着されているのでパティキュレートの漏れは発生しない。排ガスフィルタ1を装置などに取り付ける際には、排ガスフィルタ1を無機繊維質の断熱材等で包み、更にSUS等のケーシング材にて挟み込むようにして装置内に固定、保持される。

【0019】なお、本実施の形態では、流路面1a，1bの直径をほぼ同じとしたが、側面1cにテーパーをつけることにより、流路面1a側の直径を流路面1b側の直径よりも大きくしたり、その反対に流路面1b側の直径を流路面1a側の直径よりも大きく形成しても良い。なお直径が大きい方の流路面側から排ガスを排ガスフィルタ1に流入させた方が、流入面積を広くすることができるので圧力損失が低く、しかもパティキュレート等の捕集量を多くすることができる。

【0020】図2において、流路面1aには排ガスフィルタ1の排ガス流路方向に沿って断面方形状の複数の貫通孔2が設けられており、貫通孔2は多数の連通気孔が設けられた格子壁3で区切られている。格子壁3は流路面1aから流路面1bまで連続して構成されている。格子壁3の厚さt_1，t_2はそれぞれ0．2～0．3mm（200セル／平方インチ），0．4～0．5mm（100セル／平方インチ）の範囲内で構成することが好ましい。この範囲を逸脱すると、機械的強度が小さくなり過ぎたり、捕集効率が落ちたり、圧力損失が高くなる等の不具合を生じることがある。

【0021】本実施の形態では、押出し成形方法にて成形性を重視し排ガスフィルタを作製したので$t_1 = t_2$としたが、他の成形方法（例えば加工シートの積層）においては$t_1 < t_2$の関係や$t_1 > t_2$の関係にしてもよい。例えば、図2において、L方向に平行な格子壁3の厚さを厚くして、M方向に平行な格子壁3の厚さを薄くすることによって、M方向に平行な格子壁3に排ガスが流れ易くすることなどの流量調整ができるので、排ガスフィルタ1を通過した排ガスの流れを制御することができ、排ガスフィルタ1の排気効率などを調整することができる。なお、外周部（側面1cに近い部分）よりも内部の格子壁3の厚さを厚くすることによって、外周部の方が排ガスが通過し易くなるので外周部の排ガスの通過量を内部よりも多くすることができ、一般に排ガス通過量の少ない外周部に多くの排ガスを流すことができる。従って排ガスフィルタ1は各部においてパティキュレート等の捕集量を均一化することができ、排ガスフィルタ1の捕集特性を向上させることができる。また、内部よりも外周部の格子壁3の厚さを厚くすることによって、外周部の機械的強度を向上させることができ、装置内部に排ガスフィルタ1を固定する際の締めすぎや振動等による排ガスフィルタ1の破損などを防止できる。

【0022】また、格子壁3のL方向に沿ったピッチA_1とM方向に沿ったピッチA_2はそれぞれ2mm～4mmの範囲（この範囲を逸脱すると、捕集効率が落ちたり、圧力損失が高くなる等の不具合が生じることがある）内が好ましい。本実施の形態においては$A_1 = A_2$としたことによって、等方的に機械的強度を向上させることができるとともに捕集能力を各部で均一にできるので、安定した特性を得ることができる。なお、ピッチA_1及びピッチA_2を異なるサイズにすることによって貫通孔2の断面形状を長方形にし、各部で格子壁3を通過する排ガスの量を調整して、捕集能力の偏りを形成でき、排ガスフィルタ1を通過した排ガスの流量分布に変化を持たせることができるので配管の設計や排ガスフィルタ1の収納容器の設計等も容易になる。

【0023】更に、貫通孔2の形成密度は、流路面1a，1bにおいて1平方インチあたり100～200個程度が好ましい。

【0024】4は貫通孔2に詰め込まれた封止材で、封止材4は貫通孔2同士が隣合わないように詰め込まれている。この封止材4は格子壁3と同じ材料で構成すると、格子壁3と封止材4の間に熱膨張係数の違いによる格子壁3の破損などが防止できる。なお、同じ材料で格子壁3と封止材4を構成しなくても、熱膨張係数等が近いもの等を選択すれば格子壁3と封止材4は異なる材料で構成しても良い。

【0025】また、格子壁3と封止材4それぞれの構成材料の主成分を同じにすることもでき、加えて添加物の種類及びその量等を変化させてもよい。この様な構成にすることによって、格子壁3と封止材4の熱膨張係数はほぼ同じとすることができ、しかも封止材4の特性を変化させることができるので、封止材4を詰め込み易い硬さ等に調整することができるので、作業性が良くなり生産性が向上する。

【0026】封止材4を流路面1a，1bそれぞれの貫通孔2に設けることによって、図3に示す様に貫通孔2は流入孔2aと流出孔2bに区分される。流路面1a側から排ガスを排ガスフィルタ1に流し込むと、排ガスはまず流入孔2aに入り込んだ後に格子壁3を通って流出孔2bに入り込み外部に放出される。この時排ガスが多孔質の格子壁3を通過する際に排ガスの中のパティキュレート等が格子壁3内に捕集される。

【0027】排ガスフィルタ1を構成する材料としては

例えば、以下のような組成が挙げられる。

【0028】

Al_2O_3 ・・・47．2～57．8wt%

TiO_2 ・・・36．4～44．6wt%

SiO_2 ・・・ 3．0～ 9．0wt%

Fe_2O_3 ・・・ 0．7～ 2．7wt%

上記組成をそれぞれ含み、しかも多少の不純物を含んで100wt%となるように調合した。不純物としては例えばZrO_2等が挙げられる。この様にチタン酸アルミニウムを主成分とすることによって、耐熱性に優れているので、高温状態になっても溶損を起こしにくく、更に低熱膨張係数を有するので、熱応力等で割れにくい。

【0029】本実施の形態では、排ガスフィルタ1全体（格子壁3及び排ガスフィルタ1の側面1cを構成する部分）を上記材料で構成したが、少なくとも格子壁3を上記材料で構成することが好ましい。

【0030】図4は本発明の一実施の形態による排ガスフィルタの気孔分布を示すグラフである。図4において、気孔径2～150μmの間（以下第1領域と略す）と気孔径0．08～1μm（以下第2領域と略す）の間にそれぞれ極大値を持つ様な気孔分布になっていることがわかる。本実施の形態は第2領域に気孔径の極大値が存在することを特徴とし、この極大値の存在により、排ガスフィルタ1の機械的強度と耐熱衝撃性を向上させることができる。排ガス流路方向と流路方向の垂直方向について配向のない場合は、熱膨張係数も等方的になって各方向共小さな熱膨張係数を示すが、チタン酸アルミニウムに粗大なマイクロクラックが存在し機械的強度が低い。排ガス流路方向と流路方向の垂直方向についての大きな配向がある場合は各方向共高い熱膨張を示し（例えば室温～800℃の熱膨張係数：排ガス流路方向が$-2．5\times10^{-6}$/℃，流路方向と垂直な方向が$2．4\times10^{-6}$/℃）耐熱衝撃性が低いが、マイクロクラックは微細になり機械的強度が増大する。すなわち、第2領域に気孔径の極大値が存在すると、チタン酸アルミニウムの粗大なマイクロクラックを低減でき、同時に高い熱膨張を示すことはない。ちなみにこれらの気孔分布を説明すると、配向のない排ガスフィルタについて、粗大なマイクロクラックが多く発生するので、第2領域にあたる気孔分布は図4よりも気孔径が大きい方へシフトしており（例えば、0．1～2μm）細孔容積も大きい。また、配向が大きい排ガスフィルタについて、第2領域にあたる気孔分布は図4よりも気孔径が低い方へシフトしている（例えば、第2領域は0．06～0．5μm）。以上のように、第2領域はマイクロクラックによる気孔分布を示すもので、その領域によって配向の大きさが異なる。本実施例において、その第2領域は0．08～1μmの気孔径範囲となる。

【0031】次に、図4の測定方法等について説明する。図4に示すデータは水銀圧入法によって求めた。水銀圧入法は排ガスフィルタ1に水銀が1g当り何cc浸透するかを求めたものである。実験は、排ガスフィルタ1の格子壁3を所定の容器に収納し、その容器内に段階的に圧力を変化させて水銀を圧入する。容器内の圧力が低いときは、比較的大きな気孔に水銀のみが入り込み、圧力が高いときは小さな気孔にまで水銀が入り込む。従って、所定の圧力の時に排ガスフィルタ1の格子壁3に水銀が1g当り何cc入り込むかを測定することによって、所定の気孔径がどの程度存在するか測定することができる。

【0032】本実施の形態では実験に際して島津製作所（株）製（マイクロメリティックスポーアライザー9320形）を用いた。この様に測定した結果が図4に示すグラフである。

【0033】図4において縦軸は、排ガスフィルタ1の格子壁3に1g当りに浸透した水銀の容積をとり、横軸は排ガスフィルタの格子壁3と水銀を収納した容器内の圧力から求められた気孔径である。図4からわかるように、10μm付近の気孔径を有する気孔が最も多く存在していて、しかも気孔径の分布は、2つの極大値を有することがわかる。すなわち、少なくとも前述の第1領域と第2領域にそれぞれ極大値を持つことがわかる。

【0034】また、第2領域に存在する極大値を1とした場合、第1領域に存在する極大値は40～60（特に好ましくは45～55）とすることが好ましい。この範囲内で有れば十分な機械的強度と捕集能力を得ることができる。

【0035】更に第2の領域内でも気孔径の極大値は、0．2～0．5μmの間に存在することが好ましい。この範囲に気孔径の極大値がくるように排ガスフィルタ1を構成することで、機械的強度と耐熱衝撃性の向上が実現でき安定した排ガスフィルタ1を作製できる。

【0036】排ガスフィルタ1の製造方法としては、まず、所定の原料を混合し、その中にバインダや造孔剤などを入れて、坏土状とし、その坏土状体を押出し成形法にてハニカム形状に成形し、その成形体を乾燥後、封止材を充填，焼成して作製される。前述の気孔径の極大値をずらしたり、割合を変化させる場合には、造孔剤の種類，粒径，添加量やセラミック原料の粒径，形状などを変化させる。

【0037】図5は本発明の一実施の形態による排ガス浄化装置を示す概略図である。図5において10はエンジン、11は排ガスフィルタ、12は排ガスフィルタ11を収納する断熱材、13は排ガスフィルタ11及び断熱材12を収納する容器、14は排ガスフィルタ11に熱を供給する加熱体、15は容器13内の圧力を測定する圧力センサ、16は送風機、17は制御装置である。

【0038】以上の様に構成された排ガス浄化装置について以下その動作について説明する。

【0039】まずエンジン10から出た排ガスが容器1

3内に導入され、排ガスは排ガスフィルタ11でパティキュレート等を除去された後に外部に放出される。排ガスフィルタ11が所定の圧力損失値に達すると、圧力センサ15が検知し制御装置17がエンジン10を停止させる。次に、加熱体14を発熱させるとともに、送風機16を駆動させて容器13内に空気を流し込むと、熱と空気により排ガスフィルタ11に捕集されたパティキュレート等に着火する。パティキュレートの燃焼は加熱体14側から排ガスフィルタ11の他端側に向けて伝搬される。

【0040】

【実施例】次に、本発明の具体例を説明する。

【0041】（実施例）本実施例における排ガスフィルタについて、熱膨張係数、水銀圧入法で測定したデータ，機械的強度（圧縮強度），耐熱衝撃性等を試料1として（表1）にまとめた。なお、比較例（試料2，3）についても同じ表に示した。

【0042】

【表1】

試料No	熱膨張係数 室温~800℃ :10^{-6}/℃		第2領域の範囲 (μm)	機械的強度 (kgf/cm²)	再生後の状態 補集量 15g/l :100サイクル後
	流路方向	垂直方向		流路方向	
1	-1.4	1.5	0.08~1.0	61	クラック無し
2	-0.2	-0.1	0.1 ~2.0	37	クラック有り
3	-2.5	2.4	0.06~0.5	76	クラック有り

【0043】試料Noが2，1，3の順にチタン酸アルミニウム結晶粒子の配向を大きくさせた。

【0044】試料2については、排ガスフィルタの測定方向に対し熱膨張係数の差がなく殆ど配向していない。この試料2については、第2領域は0．1～2μmで粗大なマイクロクラックを有するために機械的強度が低い。また、機械的強度が低いために耐熱衝撃性も低いことがわかる。

【0045】試料3については、排ガスフィルタの測定方向に対し熱膨張係数の差が大きい。この試料3については第2領域は0．06～0．5μmで機械的強度は高いが、熱膨張係数の差が大きいために耐熱衝撃性も低いことがわかる。

【0046】試料1については、ある程度の配向性を示しながら、機械的強度は高く高耐熱衝撃性であるといえる。この試料の第2領域の範囲は0．08～1μmであった。

【0047】

【発明の効果】以上のように本発明によれば、排ガス流路方向に多数の貫通孔を有し貫通孔を形成する格子壁が多孔質セラミックからなる排ガス中のパティキュレート等を除去する排ガスフィルタであって、格子壁を水銀圧入法にて測定した際の気孔分布において、横軸に気孔径，縦軸に細孔容積をとったグラフを形成した時に、気孔径が2～150μmである第1の領域と気孔径が0．08～1μmである第2の領域に大きく分けられ、第1の領域と第2の領域においてそれぞれ極大値を有する構成としたことにより、機械的強度と耐熱衝撃性を向上できる。

【図面の簡単な説明】

【図1】本発明の一実施の形態による排ガスフィルタを示す斜視図

【図2】図2は本発明の一実施の形態による排ガスフィルタの流路面の部分拡大図

【図3】図3は本発明の一実施の形態による排ガスフィルタの断面図

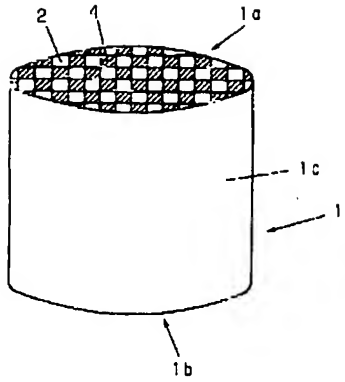
【図4】本発明の一実施の形態による排ガスフィルタの気孔分布を示すグラフ

【図5】本発明の一実施の形態による排ガス浄化装置を示す概略図

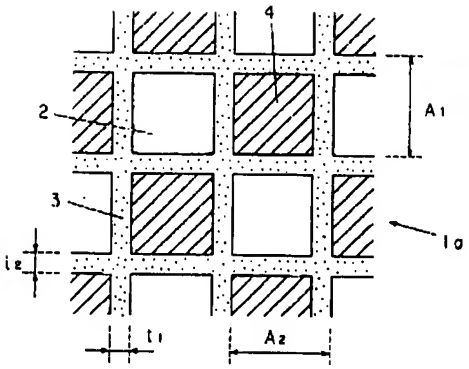
【符号の説明】

1，11　排ガスフィルタ
2　貫通孔
3　格子壁
4　封止材
10　エンジン
12　断熱材
13　容器
14　加熱体
15　圧力センサ
16　送風機
17　制御装置

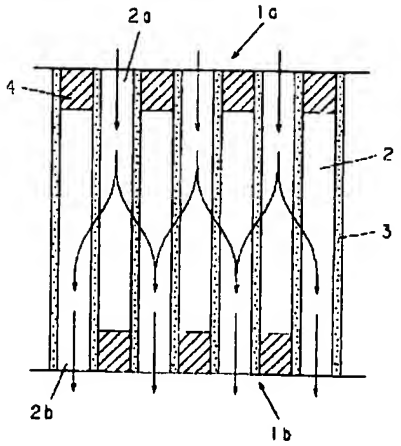
【図1】



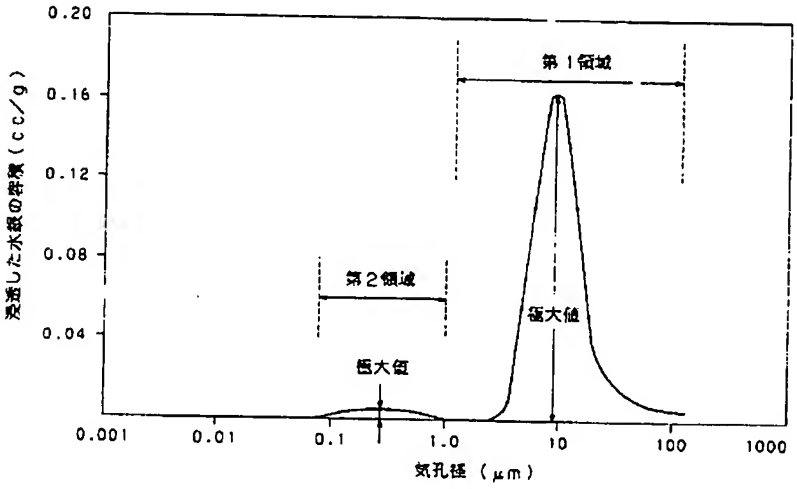
【図2】



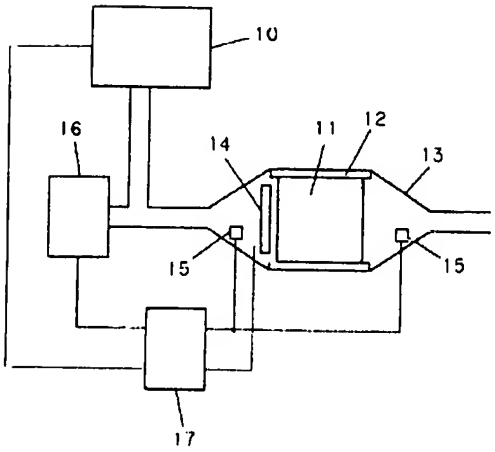
【図3】



【図4】



【図5】



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